UNITED STATES PATENT AND TRADEMARK OFFICE

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PERKINS COIE LLP
PATENT-SEA
P.O. BOX 1247
SEATTLE, WA 98111-1247

EXAMINER
MOORE, PATRICK M

ART UNIT	PAPER NUMBER
2188	

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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	10/705,809	CHOU, CHING-HAI
	Examiner	Art Unit	
	Patrick M. Moore	2188	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>06 November 2003</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8* is/are rejected.

7)☒ Claim(s) *1-8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some *   c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   Claims 1-8 have been examined.

Claim Objections

2.   Claims 1, 2, 5, 6 and 8 are objected to because of the following informalities:

a.   Claim 1, Line 1 states "method for managing disk bad sectors recovery" but is inconsistent with subsequent terminology. Examiner assumes applicant intended "method for managing bad disk sector recovery". Additional examiner assumptions are:

b.   Claim 1, Line 4 "correspondance" should be "correspondence";

c.   Claim 1, Line 8 "identifying existed bad sectors" should be "identifying existing bad sectors";

d.   Claim 1, Line 11 "data that stored in" should be "data that is stored in";

e.   Claim 1, Line 12 "bad-sector-table entries" should be "bad sector table entries";

f.   Claim 2, Line 2 "occurr" should be "occur";

g.   Claim 2, Lines 4, 6 and 8 "pointed by its entry address" should be "pointed to by its entry address";

h.   Claim 5, Line 1 "managing disk bad sector recovery" should be "managing bad disk sector recovery";

i.   Claim 5, Line 3 "correspondance" should be "correspondence";

j.   Claim 5, Line 7 "bad-sector entry" should be "bad sector entry";

    k.   Claim 6, Line 4 "mirrored data from a RAID-1 or striped data RAID-5 from"

should be "mirrored data from a RAID-1 or striped data from a RAID-5 from";

    l.   Claim 8, Line 3 "damage" should be "damaged"; and

    m.   Claim 8, Lines 13 and 14 "read/write data to the reserve sector" should be

"read/write of data from/to the reserve sector".

    Appropriate correction is required.

3.   Claim 4 is objected to because it is unclear what significance the quotes have

surrounding "on" in Line 4. Appropriate correction is required.

4.   Claim 8 is objected to because it is unclear whether the term "true" refers to the

bit being "on" (as is consistent with previous claims) or if there is an additional limitation

of only the damaged flag.

    Appropriate correction is required.

Claim Rejections - 35 USC § 112

    The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5.   Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

    a.   Claim 1 (Line 6), Claim 2 (Lines 4, 6, 8), Claim 6 (Line 4), Claim 7 (Line 4)

and Claim 8 (Lines 9-12 and 16) recite the limitation "it" or "its". There is

insufficient antecedent basis for each of these limitations in the claims and such

terminology does not enable one of ordinary skill in the art to understand applicant's invention. Appropriate correction is required.

b.   Claim 1 recites "the bad sectors" in Line 10, "the data" and "said bad sector" in Line 11, and "the bad sectors" in Line 12. There is insufficient antecedent basis for each of these limitations in the claim. Appropriate correction is required.

c.   Claim 2 recites the limitation "situations that may occur to a bad sector within a disk block" in Lines 2-3 and "flag a sector pointed [to] by its entry address" in Lines 4, 6 and 8. The claim's language suggests that the "three bits" are indicators of the disclosed bad sector's status and not the "current status of [the bad sector entry's] associated reserve sector" as disclosed in Claim 1. In order to provide a complete examination on the merits, Examiner assumes the disclosed bits indicate status of sectors within the disk's reserved area (Figure 1, # 104) for the remainder of this Action. Appropriate correction and clarification are required.

d.   Claims 3-5 and 8 recite the limitation "BSM table", which lacks sufficient antecedent basis in the claims. For the remainder of this Office Action, Examiner assumes the limitation refers to the "bad-sector-mapping table" as discussed in the Specification. Appropriate correction is required, which could include adding this terminology to each independent claim.

e.   Claim 3 recites the limitation "the BSM table content for sectors" in Line 5.
There is insufficient antecedent basis for this limitation. Appropriate correction is
required.

f.   Claim 4 recites the limitations "the temporary flag" in Line 4 and "the
invalid flag" in Line 6. There is insufficient antecedent basis for each of these
limitations. Appropriate correction is required.

g.   Claim 4 recites the limitations "the sector" in Line 4 and "the sector's data"
in Line 6. There is insufficient antecedent basis for each of these limitations.
Appropriate correction is required.

h.   Claim 4 recites the limitation "the previous BSM table" in Line 5. This
appears to be a duplicate recitation of the elements as only one (1) BSM table is
discussed in the Specification. Appropriate correction is required.

i.   Claim 5 recites the limitation "the content" in Line 9 and "the system
operation" Line 10. There is insufficient antecedent basis for each of these
limitations. Appropriate correction is required.

j.   Claim 5 recites similar limitations which appear to be duplicate recitations
of the elements: "constructing a new bad-sector entry to the bad-sector-mapping
table;" in Line 7 and "constructing new entries into the BSM table;" in Line 12.
Examiner assumes that these are unintentional duplicates. However,
appropriate correction is required.

k.   Claims 6-8 are dependent on "The system of Claim 5" which has
insufficient antecedent basis because Claim 5 is a method. As indicated by

Application's Title, Examiner assumes Claim 5 should disclose an apparatus of managing bad disk sector recovery. Appropriate correction is required.

l.   Claim 6 recites the limitation "the Raid type" and "the system-provided Raid configuration" in Line 3 and "the rebuilt sector" in Line 7. There is insufficient antecedent basis for each of these limitations. Appropriate correction is required.

m.   Claim 7 recites the limitation "the invalid bit" in Line 5. There is insufficient antecedent basis for this limitation. Appropriate correction is required.

n.   Claim 7 recites the limitation "the operation for recovery" in Line 9. There is insufficient antecedent basis for this limitation. Appropriate correction is required.

o.   Claim 8 further limits multiple status flags, which are not disclosed in Claim 8 or Claim 5. Therefore, these following limitations lack sufficient antecedent basis: "the ignore flag" (Line 3), "the damage flag" (Lines 3-4, 14), "the invalid flag" (Lines 5, 7, 16), "the temporary flag" (Lines 9, 12). Appropriate correction is required.

p.   Claim 8 recites the limitation "freeing" in Line 5, but terminology is unclear as whether this refers to destroying the bad sector entry header field's structure, setting the invalid flag to 'off' or some other procedure. Appropriate correction is required.

q.   Claim 8 recites the limitation "the system" in Lines 7 and 17. As

mentioned above, such limitations lack sufficient antecedent basis and Examiner

assumes applicant will disclose an apparatus. Appropriate correction is required.

r.   Claim 8 recites the limitations "the address field" in Line 9, "the

corresponding entry" and "content" in Line 11 and "the old one" in Line 14. There

is insufficient antecedent basis for each of these limitations. Appropriate

correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

5.   Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Rafanello et al. (US Patent 6,427,215 B2) in view of Nagaraj et al. (US Patent

5,913,927).

a.   As for Claim 1, Rafanello et al. discloses a computer-implemented method

for managing disk bad sectors recovery comprising: maintaining a bad-sector-

mapping table (Figure 2, # 214 and Column 4, Lines 7-10) containing a set of

bad sector entries (Figure 2, # 216 and Column 4, Lines 12-17) and a check sum

field (Column 4, Lines 3-4), wherein each bad sector entry has a one-to-one

correspondence to a reserve sector and contains an address field for storing an

address of a bad sector and a header field for indicating the current status of its

associated reserve sector (Column 4, Lines 17-21); receiving I/O requests issued

from an operating system (Column 4, Lines 37-45 and Column 5, Lines 49-55);

identifying existed bad sectors from said bad-sector-mapping table (Column 5,

Lines 56-60); associating the reserve sectors for the recovery (Column 6, Lines

59-66); finding the bad sectors that cause an I/O failure (Column 6, Lines 51-56);

recovering the bad sectors (Column 4, Lines 43-45) and constructing new bad-

sector-table entries (Column 4, Lines 12-14); and reporting to said operating

system if said I/O request is successful (Column 6, Lines 45-50 and Figure 5, #

504). In Rafanello et al., the check sum field is known as "error correcting codes

(ECC)" (Column 3, Line 58) and/or "a cyclic redundancy check (CRC)" (Column

4, Line 3-4) and are popular check sum methods known to those of ordinary skill

in the art.

Rafanello et al. does not expressly disclose rebuilding the data that is

stored in said bad sector or updating a parity block for RAID-type data recovery.

However, Nagaraj et al. discloses rebuilding the data that is stored in said bad

sector (Column 2, Lines 49-53); and updating a parity block for RAID-type data

recovery (Column 3, Lines 6-9). Additionally, Rafanello et al. and Nagaraj et al.

are analogous art because they are from the same field of endeavor: recovery

management of bad disk data using bad/defective sector tables.

At the time of invention, it would have been obvious for one of ordinary

skill in the art to combine the RAID recovery methods taught by Nagaraj et al.

with Rafanello et al.'s defect mapping table because using RAID recovery system

was a well-known method for minimizing data loss and increasing fault tolerance.

Additionally, Rafanello et al. anticipates a RAID system combined with their

disclosed invention as "any data relocation performed by a disk drive" (Column 7,

Line 1-6) and both references disclose bad data tables to store information about

faulty disk sectors. The motivation for combining Rafanello et al. with Nagaraj et

al. would have been to avoid declaring a sector unrecoverable (Rafanello et al.

Column 5, Lines 16-22) by creating redundant data sources, such as RAID

mirroring or striping. Redundant data would vastly increase the reliability of

Rafanello et al.'s data recovery process (Figure 3, #'s 304, 306 and 308).

Therefore, it would have been obvious to combine Rafanello et al. with

Nagaraj et al. to obtain the invention as specified in Claims 1-8.

b.   As for Claim 2, Rafanello et al. discloses a plurality of flags to indicate

various states of the recovered data stored in the reserve disk sectors including a

damaged bad sector flag (Column 4, Lines 4-6) and an invalid (or "unusable")

data sector flag (Column 4, Lines 57-60). The difference between a permanently

damaged bad sector and temporary bad sector is incorporated into the flags

provided by Rafanello et al.'s '"Bad" bit or flag'. Rafanello et al. discusses that a

sector may become permanently damaged (Column 5, Lines 16-22) and provides

a flag to indicate that scenario. Additionally, Rafanello et al. discusses a sector

that may contain temporarily bad data until the next write procedure (Column 4,

Lines 57-60). As such, Rafanello et al. has clearly anticipated the three flags

disclosed by Claim 2.

c.   As for Claim 3, Nagaraj et al. discloses updating a parity block further

comprises: calculating new data for the parity block (Column 3, Lines 6-8); writing

new data to the parity block (Column 3, Lines 8 and 9); and updating the BSM

table content for sectors with unavailable data (Column 3, Lines 2-6). Rafanello

et al. also discloses updating the BSM table content for sectors with unavailable

data in Column 6, Lines 58-65).

d.   As for Claim 4, Rafanello et al. discloses updating the BSM table further

comprises: constructing new entries (Column 6, Lines 58-65); setting the

temporary flag "on" for a sector in case when the sector was not listed in the

previous BSM table; setting the invalid flag on for a sector in a parity block in

case when the sector's data cannot be used (Column 6, Lines 58-65).

Rafanello et al. states that the newly created entry will have "status

information regarding the data within the replacement sector." In light of

Rafanello et al.'s previous disclosure (Column 4, Lines 17-21), Examiner

understands that "status information" refers to the "flag as well as other

information about the sector". Furthermore, it is understood that all flags are set

properly to indicate the reserved sectors status upon construction of a new table

entry.

e.   As for Claim 5, Rafanello et al. discloses a method of managing disk bad

sector recovery comprising: maintaining a bad-sector-mapping table (Figure 2, #

214 and Column 4, Lines 7-10) containing a set of bad sector entries (Figure 2, #

216 and Column 4, Lines 12-17) and a check sum field (Column 4, Lines 3-4),

wherein each bad sector entry has a one-to-one correspondence to a reserve sector and contains an address field for storing an address of a bad sector and a header field for indicating the current status of its associated reserve sector (Column 4, Lines 17-21); checking an I/O request and an I/O result (Column 5, Lines 49-55 and Column 5, Line 63-Column 6, Line 3); constructing a new bad-sector entry to the bad-sector-mapping table (Column 6, Lines 58-65); identifying bad sectors existing in the bad-sector-mapping table (Column 5, Lines 56-60); updating the content of the bad-sector-mapping table (Column 6, Lines 58-65); associating corresponding reserve sectors to the system operation (Column 6, Lines 58-65) finding bad sectors that causes an I/O failure (Column 6, Lines 51-56); recovering the bad sector by using the reserved sector (Column 4, Lines 43-45 and 12-14); and storing the BSM table back to the disk device (Column 4, Lines 7-9).

However, Rafanello et al. does not expressly disclose rebuilding the data that is stored in said bad sector. Nagaraj et al. discloses rebuilding the data that is stored in said bad sector (Column 2, Lines 49-53). At the time of invention, it would have been obvious for one of ordinary skill in the art to combine the RAID data rebuilding methods taught by Nagaraj et al. with Rafanello et al.'s defect mapping table because using RAID recovery system was a well-known method for minimizing data loss and increasing fault tolerance. Additionally, Rafanello et al. anticipates a RAID system combined with their disclosed invention as "any data relocation performed by a disk drive" (Column 7, Line 1-6) and both

references disclose bad data tables to store information about faulty disk sectors. The motivation for combining Rafanello et al. with Nagaraj et al. would have been to avoid declaring a sector unrecoverable (Rafanello et al. Column 5, Lines 16-22) by creating redundant data sources, such as RAID mirroring or striping. Redundant data would vastly increase the reliability of Rafanello et al.'s data recovery process (Figure 3, #'s 304, 306 and 308).

f.   As per Claim 6, Nagaraj et al. discloses the step of rebuilding data of a bad sector further comprises: reading mirrored data from a RAID-1 or striped data RAID-5 from its corresponding disk sectors, otherwise indicating an unsuccessful rebuilding (Column 2, Lines 45-49); and constructing the striped data for the rebuilt sector in the case of a RAID-5 (Figure 6, #103 and Column 2, Lines 49-53).

Determining the RAID type and reading data from the RAID system is disclosed as follows: The process described in Figure 6 and Column 7, Lines 45-53, which describe the data rebuilding and reconstruction process. The flow illustration in Figure 6 must be aware of the RAID type employed by the system in order to locate the corresponding disk sectors storing redundant data. Because the mirrored/striped data could not be reconstructed without knowing the RAID type and then reading from the corresponding disk location, Nagaraj et al. must have possessed the entirety of invention disclosed in Claim 6.

g.   As per Claim 7, Rafanello et al. discloses recovering data of a bad sector further comprises: constructing a new entry for the bad-sector-mapping table if

allowed (Column 6, Lines 58-65); writing the data of the bad sector into its

reserve sector in the case when the bad sector data is available (Column 5,

Lines 37-39); otherwise setting the invalid bit on in the case when the bad sector

data is unavailable (Column 5, Lines 16-22); and reporting whether the operation

for recovery is successful or not (Column 6, Lines 45-50).

Rafanello et al. discloses (specifically Column 6, Lines 58-65 and Figure

2, #'s 210 and 212) that the CRC character (one form of "check sum" as

explained above) is included in the ID portion of the reserved sector and would

be updated upon creating a new entry for the bad-sector-mapping table. In other

words, it would be understood by one of ordinary skill in the art that the check

sum value must be updated when constructing a new entry as disclosed by

Rafanello et al. in Column 6, Lines 58-65.

Allowable Subject Matter

6.   Claim 8 is objected to as being dependent upon a rejected base claim, but would

be allowable if rewritten in independent form including all of the limitations of the base

claim and any intervening claims and amended to overcome the above objections and

35 U.S.C. 112 rejections.

Conclusion

7.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure:

a.   Ewert et al. (US Patent 5,166,936) contains prior art regarding a bad sector relocation routine using an interleave table on a RAID system, but does not permanently store/remap sectors to a reserved area of the disk.

b.   Russell (US Patents 6,332,204 and 6,247,152) was the parent application sharing similar subject matter and inventors as Rafanello et al. (cited above).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick M. Moore whose telephone number is (571) 272-1239. The examiner can normally be reached on M-F 8:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabahn can be reached on (571) 272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PMM

GARY PORTKA
PRIMARY EXAMINER